REMARKS

The present response is intended to be fully responsive to all points of objection and/or rejection raised by the Examiner and is believed to place the application in condition for allowance. Favorable reconsideration and allowance of the application is respectfully requested.

Applicants assert that the present invention is new, non-obvious and useful. Prompt consideration and allowance of the claims is respectfully requested.

Status of Claims

Claims **1, 5-18, 21-32, 36** and **38-40** are pending.

Claims **1, 5-18, 21-32, 36** and **38-40** have been rejected.

Claims **1, 17,** and **30** have been amended in this submission. Applicants respectfully assert that the amendments to the claims add no new matter. It will be noted that these amended elements do not add new matter and do not require further search, as they are inserted from previously pending claims, now cancelled.

CLAIM REJECTIONS

35 U.S.C. § 102 Rejections

In the Office Action, the Examiner rejected claims 1, 10, 11, 13-18, 26-30, 32, 36 and 38-40 under 35 U.S.C. § 102(e), as being anticipated by Lee (US Patent No. 7,365,722). Applicants respectfully traverse the rejection for at least the below reasons.

The Lee reference has been discussed at length in a prior submission and will only be discussed briefly herein. Claim 1 recites a color display device for displaying a more-than-three color image, the device comprising a driver control module that includes a conversion module for converting image data into converted sub-pixel data representing the color image in terms of four or more primary colors. The conversion module includes a first converter for converting the image data into intermediate sub-pixel data of four or more primary colors,

and a second converter for converting the intermediate sub-pixel data into said converted sub-pixel data using at least one conversion matrix.

In the most recent amendment, claim 1 was amended to recite that the second converter is "for converting ***based on a position of each said sub-pixel element independently*** said intermediate sub-pixel data into said converted sub-pixel data using at least one conversion matrix, wherein data for each of said four or more primary colors of said converted sub-pixel data is in gray-level format."

In the current Office action, the Examiner again rejected claim 1 over the Lee reference. Regarding the second converter, the Examiner stated that Lee included a "second converter ([data optimizer] 602) for converting based on a position of each said sub-pixel element independently said intermediate sub-pixel data into said converted sub-pixel data. . .", pointing to Lee col. 10, lines 32-38 and 59-65, col. 11, lines 42-43, and col. 12, line 3 – col. 13, line 26.

Applicants have previously discussed Lee, col. 10, lines 32-38 and lines 59-65, and col. 11 lines 42-43, at length. For example, these disclose:

> . . . The image signal modifier 610 of the signal controller 610 converts the three-color image signals R, G and B into four-color image signals and processes and modifies the four-color image signals suitable for the operation of the panel assembly 300 on the basis of the input control signals and the input image signals R, G and B. (Lee, col. 10, lines 32-39, emphasis added).
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> * * *
>
> An image signal modifier according to an embodiment of the present invention includes a data converter 601 for converting three-color image signals R, G and B into four-color image signals R, G, B and W, a data optimizer 602 for optimizing the four-color image signals R, G, B and W. . . (Lee, col. 11, lines 38-43, emphasis added).

Nowhere in this portion (or elsewhere) does the Lee reference disclose that the data optimization of data optimizer 602 converts intermediate sub-pixel data into converted sub-pixel data based on a position of each said sub-pixel element independently, as recited in claim 1.

The above clearly refers to color corrections for the entire device (e.g., "For an LCD having no serious gray inversion problem or no power consumption problem. . ."), and not a pixel-level adjustment ("converting ***based on a position of each said sub-pixel element independently*** said intermediate sub-pixel data into said converted sub-pixel data"). In contrast, as disclosed in the specification of the present application:

> [0080] A variation of the brightness values of each of the primaries across the display may be determined, e.g., during a testing process, and based on the brightness variation, a set of position-dependent homogeneity correction factors corresponding to each of the primary colors may be calculated. For example, each of the homogeneity correction factors may correspond to one of the primaries and a position on the display. Data representing the position-dependent homogeneity correction factors corresponding to each of the primary colors may be stored, for example, in memory 314. The homogeneity correction factor data may be subsequently used in order to correct a brightness variation across the display, as described below. According to other embodiments of the invention, the brightness variation may be determined using any other method, e.g., during operation of the display device. (emphasis added)
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> * * *
>
> [0084] According to exemplary embodiments of the invention, controller 312 may determine, e.g., based on one or more of signals 324, a position of a pixel of the display intended to reproduce the pixel data of signals 603, e.g., as described above with reference to FIG. 4. Controller 312 may then retrieve from memory 314 a set of, e.g., n, homogeneity correction factors corresponding to the determined pixel position, and provide module 700 with a set of, e.g., n, signals 704 having the value of the retrieved set of, e.g., n, correction factors, respectively. (emphasis added)

The data optimizer 602 does not optimize data as recited in claim 1 because the optimization of data optimizer 602 is not position-dependent.

In the current outstanding Office action, and in the Response to Arguments, the Examiner has now also cited Lee col. 12, line 3 – col. 13, line 26, excerpted below:

> The data optimizer 602 selects an optimal set among the plurality of sets of four-color image data R, G, B and W considering the characteristics of the LCD such as resolution, power consumption, visibility, etc.

First, the data optimizer 602 distinguishes an achromatic component W_0 and chromatic components R_0, G_0 and B_0. . .

A maximum gray W' of the white pixel WP and associated grays R', G' and B' of the red, green and blue pixels RP, GP and BP for a 256 gray LCD are given by. . .

A minimum gray W' of the white pixel WP and associated grays R', G' and B' of the red, green and blue pixels RP, GP and BP a 256 gray LCD are given by. . .

When the gray W' of the white pixel WP is intended to be equal to the grays R', G' and B' of the red, green and blue pixels RP, GP and BP. . .

It is preferable that the difference in the grays between the white pixel WP and the other pixels RP, GP and BP is maximized for improving resolution or visibility. For example, the image deterioration due to gray inversion becomes reduced and thus the lateral visibility is improved as the gray difference between the white pixel WP and the other pixels RP, GP and BP becomes large, in particular for a twisted nematic (TN) type LCD. In this case, the selected grays of the respective pixels are determined by Equation 2 or 3.

When representing a gray, the voltage applied to the white pixel WP decreases as the voltage applied to each of the red, green and blue pixels RP, GP and BP increases. Accordingly, the increase of the voltage applied to the white pixel WP makes the decrease of the voltage applied to each of the red, green and blue pixels RP, GP and BP and thus it reduces total power by multiple times. As a result, it is preferable that a voltage applied to the white pixel WP is as large as possible while that applied to each of the other pixels RP, GP and BP is as small as possible. In detail, it is preferable that the gray for the white pixel WP is as large as possible while the grays for the red, green and blue pixels RP, GP and BP are as small as possible for a normally black mode LCD. For a normally white mode LCD, however, it is preferable that the gray for the white pixel WP is as small as possible while the grays for the red, green and blue pixels RP, GP and BP are as large as possible for a normally white mode LCD since the gray voltage becomes large as the gray decreases in a normally white mode LCD. In this case, the selected grays of the respective pixels are determined by Equation 2 or 3.

For an LCD having no serious gray inversion problem or no power consumption problem, it is preferable that the gray of the white pixel WP is similar to the grays of the red, green and blue pixels RP, GP and BP for better image quality. In particular, since the pixels on a screen of a low resolution LCD such as TV may be distinguished, the

> intensities of the pixels are preferably similar to each other to give uniformity. However, since the luminance of the white pixel WP is much higher than the red, green and blue pixels RP, GP and BP, it is preferable that the gray of the white pixel WP is relatively low compared with the grays of the red, green and blue pixels RP, GP and BP. In this case, the selected grays of the respective pixels are determined by Equation 4.
>
> The above optimization is merely an example, and other optimizations can be applicable considering the highest value of the gray of each pixel, for example, 255.

Specifically, the Examiner stated that this portion of Lee:

> discusses the optimization of the sub-pixel values carried out by the second converter, in which the voltage level of the white sub-pixel is adjusted relative to the voltage values of the red, green and blue sub-pixels. The sub-pixels are arranged so that the different colors have a different positional location relative to each other, and the value of the white sub-pixel must be adjusted so that proper color balance may be achieved.

The Examiner concludes that this optimization meets the element of "based on a position" in claim 1. Applicants respectfully disagree.

The Lee reference discusses RGBW displays, i.e., displays in which each pixel is composed from RGBW sub-pixels. As best understood, the modifications discussed in the Lee reference and cited by the examiner only change the white voltage with respect to the RGB voltages. More importantly, this modification is applied **globally over the entire screen**, and the values are therefore not position-dependent. That is, in the Lee reference, **the same correction must be applied to pixels of the same RGB input at different positions on the panel**.

The Examiner further stated that the "based on a position" element of claim 1 is "vague and can be interpreted in many ways, not only the specific definition given in the specification," and suggested the claim be amended to be more specific.

In order to advance prosecution of this application, Applicants have amended claims 1 and 17 to recite that "the converted sub-pixel data depends on the intermediate sub-pixel data and a position of the pixel displaying the data" thereby allowing the same intermediate sub-pixel data to be converted to different converted sub-pixel data depending on the position of

the pixel displaying the data. Claim 30 has been amended to recite that the driver control module is to controllably activate one or more drivers of an array of sub-pixel elements of at least four different colors based on said image data signals, "wherein said driver control module is able to generate one or more driver signals for activating said drivers based on one or more position-dependent display attributes independently related to individual positions in said display device and one or more image attributes related to said color image."

These elements of claims 1, 17, and 30 are not disclosed or rendered obvious by the Lee reference.

Second, Applicants continue to maintain arguments presented in the prior response to Office action, including that signal controller 600 does not satisfy every element of claim 1 with respect to the controller. Claim 1 recites that the controller is "to control said conversion module to convert said image data into said converted sub-pixel data based on said one or more display-attributes and said one or more image-attributes."

In the Lee reference, signal controller 600 does no such thing with respect to data optimizer 602. The only input to data optimizer 602 that is shown (e.g., in Fig. 7) or described is the RGBW data. The Examiner pointed to col. 10 lines 23-45. Applicants have carefully reviewed this portion of the Lee reference, and have found no mention of the controller 600 controlling data optimizer 602 to convert said image data into said converted sub-pixel data based on said one or more display-attributes and said one or more image-attributes, as recited in claim 1.

In contrast, for example, claim 1 recites that the controller is "to control said conversion module to convert said image data into said converted sub-pixel data based on said one or more display-attributes and said one or more image-attributes, wherein said controller is able to determine one or more values of said at least one conversion matrix based on at least one display attribute and at least one image attribute, and to provide said values of said at least one conversion matrix to said second converter."

Accordingly, claims 1, 10, 11, 13-18, 26-30, 32, 36 and 38-40 are allowable over the Lee reference.

Applicants further wish to point out certain dependent claims that recite claim elements that are independently allowable over the Lee reference.

As mentioned above, the display-attributes may be attributes of the particular display device, rather than merely features of all such displays. Accordingly, claim 13 recites that "said one or more display-attributes comprise at least one attribute selected from the group consisting of a configuration of one or more defective sub-pixel elements within said array, a brightness non-homogeneity of said display device, and a color non-homogeneity of said display device." The Examiner has pointed to Lee, col. 6 lines 19-23, reproduced below.

> Although the sequence of the pixels in a pixel row can be altered, it is preferable that the green pixels GP are far from the white pixels WP since the white pixels WP and the green pixels GP has transmittance higher than the red pixels RP and the blue pixels BP.

However, this portion does not relate to the display attributes, or to a controller determining values of a conversion matrix based on such display attributes, or a second converter converting intermediate sub-pixel data into converted sub-pixel data based on such conversion matrix. Lee certainly does not disclose a device-specific display attribute selected from "a configuration of one or more defective sub-pixel elements within said array, a brightness non-homogeneity of said display device, and a color non-homogeneity of said display device," as recited in claim 13.

Accordingly, claim 13 is allowable over the Lee reference. Claims 28 and 38 are allowable for similar reasons.

The image-attributes may be attributes of the particular image being displayed, rather than merely features of any image. Claim 14 recites that "said one or more image-attributes comprise one or more attributes selected from the group consisting of a perceived bit-depth of pixels of at least part of said image, a viewed smoothness of at least part of said image, a brightness uniformity of at least part of said image, a color uniformity of at least part of said image, and a rendering scheme to be applied to at least part of said image." The Examiner

has pointed to the same portion of the Lee reference as called out above with respect to claim 13.

It is unclear how the attributes described in the same paragraph are both display attributes and image attributes. In any event, this portion of the Lee reference certainly does not relate to image attributes, or to a controller determining values of a conversion matrix based on such image attributes, or a second converter converting intermediate sub-pixel data into converted sub-pixel data based on such conversion matrix. Lee does not disclose an image-specific image attribute selected from "a perceived bit-depth of pixels of at least part of said image, a viewed smoothness of at least part of said image, a brightness uniformity of at least part of said image, a color uniformity of at least part of said image, and a rendering scheme to be applied to at least part of said image," as recited in claim 14.

Accordingly, claim 14 is allowable over the Lee reference. Claims 29 and 39 are allowable for similar reasons.

35 U.S.C. § 103 Rejections

In the Office Action, the Examiner rejected claims 6, 7, 12, 22, and 23 under 35 U.S.C. § 103(a), as being unpatentable over Lee (US Patent No. 7,365,722) in view of Kumada et al. (US Patent No. 5,563,725).

In the Office Action, the Examiner rejected claims 9 and 25 under 35 U.S.C. § 103(a), as being unpatentable over Lee (US Patent No. 7,365,722) in view of Inoue (US Patent No. 5,896,178).

Neither of the Kumada and Inoue references rectify the deficiencies of the Lee reference, discussed hereinabove. Accordingly, the rejected dependent claims are allowable, at least for depending from allowable base claims.

In view of the foregoing amendments and remarks, Applicants assert that the pending claims are allowable. Their favorable reconsideration and allowance is respectfully requested.

Should the Examiner have any question or comment as to the form, content or entry of this Amendment, the Examiner is requested to contact the undersigned at the telephone number below. Similarly, if there are any further issues yet to be resolved to advance the prosecution of this application to issue, the Examiner is requested to telephone the undersigned counsel.

Please charge any fees associated with this paper to deposit account No. 50-3355.

Respectfully submitted,

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